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RECENT LITERATURE

Hinton, Martin A. C. REPORT ON THE HOUSE RATS OF INDIA, BURMA, AND CEYLON. Journ. Bombay Nat. Hist. Soc., vol. 26, pp. 59-88, December 20, 1918, and pp. 384-416, May 20, 1919.

After studying the very large series of house rats obtained by the Mammal Survey of India together with the Indian material in the British Museum Mr. Hinton concludes that of the 21 known Indian, Burmese and Ceylonese forms no less than 17 (12 new) are subspecies of *Rattus rattus*. His general observations on these subspecies are of unusual interest. "Turning now to India," he says (pp. 65-68) "the rats listed in the Survey Reports as '*rufescens*,' or '*rufescens* var.,' afford us with problems of considerable complexity. In the first place, although I am unable to find any character in the dentition, skull, or external parts, to distinguish any of them satisfactorily from *R. rattus*, the range of variation is enormous. Indian skulls with well worn teeth have the condylo-basal length ranging between 34 and 44 mm. The fur may be long, soft, dense and without spines; or it may be short, thin, and harsh, with numerous spiny bristles. The dorsal colour varies between bright rufous, or warm olivaceous tints on the one hand, to dull tawny, or cold mixtures of black and grey on the other. The underparts may be pure white or pale lemon; or they may be slaty, with or without a rusty tinge or bloom. The hands and feet may be white or yellowish above, with or without dusky markings; or they may be wholly blackish brown in colour. The mammary formula may be 2-3=10 or 3-3=12. Every intermediate stage between the extremes indicated may be found in the collections before me. Nevertheless, much of this variation has a definite geographical value; and where long series are available from one locality or district, the rats are usually found to conform closely to one or more definite local types. It is therefore possible to define a considerable number of local races or subspecies.

The members of the *rattus* group seem to afford an exception to the rule, so general for wild mammals, that not more than one subspecies of a given species, or not more than one of two or more very closely allied species can inhabit a given locality. But these rats are capable of playing many parts in warm countries; thus we find them following a free life in fields and hedgerows, far from houses, or high up among the branches of trees in forests; or they may lead a purely parasitic existence in human habitations or shelters. It is a poor sort of locality which refuses at least two "niches in nature" for *rattus*; and the semi-domesticated stocks, at all events, of this species have frequent opportunities for prospecting and touring conferred upon them by railways, wheeled carriages, and shipping.

Like other murines, this species shows, within certain limits, an almost startling plasticity. Its structure responds readily to the demands of purely local requirements. If necessary colour or the quality of the coat are modified; a change in diet induces modifications in the development or the "set" of the muscles of mastication; and these in turn mould the skull, or lead to the lengthening or shortening of the tooth-rows.

Considerations such as those mentioned in the preceding paragraphs lead us to realize the hopelessness of attempting to disentangle the history of the rats in large towns or ports like Calcutta or Bombay. In such places the rat population

is a motley horde, representing the progeny of truly native rats crossed with the descendants of old wanderers and with newcomers not only from the neighbouring hinterland but from all parts of the world. It is therefore only in the more remote parts of the country that we can reasonably expect some measure of success to crown such efforts. . . .

Mr. Wroughton has already brought before the Society (*J. B. N. H. S.*, Vol. XXIII, p. 474) the view that the white bellied forms of *R. rattus* in India and Burma represent the primitive wild form of the species; and that the dark bellied types are parasites, the darkening of the underparts, no less than the darkening of the back, being the outward indication of domesticity or parasitism. In support of this view, one may point to the general similarity of the Indian white bellied forms to the wild race, *R. r. frugivorus*, of the Mediterranean region; to their wide distribution, both in the mountains and in the plains, in India and Burma: and to the wild life which many of them lead in the jungles. Further on investigating these white bellied rats in detail, we find that they behave very much as do normal wild mammals as regards geographical variation and that it is therefore possible and comparatively easy to arrange them in geographical races or subspecies.

With regard to the dark bellied rats the case is different. They are largely restricted to districts possessing substantial houses; they are more frequently caught within doors and far less frequently in the open. Close investigation of their structure leads to nothing but confusion; the variation is largely individual or colonial, and scarcely at all geographical. In some districts, as in Kumaon, such rats seem to have little or no connection with the white bellied forms; in other places, they differ from their white bellied companions merely in colour and to a trifling extent in skull—the cranial differences being readily susceptible of a physiological explanation, . . . ; finally, in still other districts, the difference is purely one of colour and even that sometimes breaks down. One concludes from this that the dark bellied rats are of diverse origin; some seem to have been produced, in the localities where they are now found, from the local white bellied race; others have found their way to their present habitations from other more or less remote districts of the country, or even from abroad; and lastly, many are doubtless to be regarded as the mixed descendants of both native and imported stocks."

It will readily be seen that the interrelationships of these rats presents a complicated problem and one which is rarely met with among mammals. Of particular importance is Mr. Hinton's suggestion that, in the *Rattus rattus* group, distinct subspecies are probably being developed in different "niches in nature" at single localities. While the facts now at hand may not be sufficient to prove the occurrence of such development among the rats under discussion they clearly indicate the possibility that it is taking place. Something of the kind must be assumed as the first step in establishing lines of "local adaptive radiation," a process which appears to have exercised great if not dominating influence throughout the evolutionary history of all mammals. At present, however, this process is known from its later or finished results only; its earlier stages have not been demonstrated. Detailed observations on the living house rats of India in their natural surroundings are therefore much to be desired. A clear understanding of the early stages of adaptive radiation might be one of the results.

—G. S. Miller.